

NON-PUBLIC?: N
ACCESSION #: 8805310341
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Calvert Cliffs, Unit-2 PAGE: 1 of 4

DOCKET NUMBER: 05000318

TITLE: Low Steam Generator Water Level Reactor Trip Due to #21 Steam
Generator Feed Pump Trip
EVENT DATE: 04/27/88 LER #: 88-004-00 REPORT DATE: 05/20/88

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: H. E. Nixon, Secondary Systems Engineer TELEPHONE #: 301-260-4016

COMPONENT FAILURE DESCRIPTION:
CAUSE: B SYSTEM: JA COMPONENT: CNV MANUFACTURER: R335
REPORTABLE TO NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT: At 0848, April 27, 1988, Calvert Cliffs Unit 2 tripped on Low
Steam Generator Water Level after #21 Steam Generator Feed Pump tripped
for no apparent reason. Subsequent testing and investigation has yielded
no prior symptoms or root cause for the pump trip.

In addition to the permanent monitoring equipment, temporary monitoring
equipment has been installed on the trip circuitry associated with various
Steam Generator Feed Pump Turbine trips. The #21 Atmospheric Dump Valve
was automatically controlling Reactor Coolant System temperature
improperly. A control signal of incorrect magnitude from the Reactor
Regulating System was found. The control signal was readjusted.

Corrective Action

1. The temporary additional monitoring of the trip circuit for #21 Steam
Generator Feed Pump will be continued in an effort to determine the
root cause of this event. Specific corrective actions to prevent
recurrence can not be delineated until the root cause is determined.

2. An evaluation of replacements for the currently installed Turbine Thrust Bearing Wear Monitor is in progress.

(End of Abstract)

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DESCRIPTION

At 0847, April 27, 1988, the #21 Steam Generator Feed Pump (SGFP) (EIIS SJ-P) tripped for no apparent reason. The Operators immediately took actions to emergency borate the Reactor Coolant System (RCS) (EIIS AB) and drive in the Control Element Assemblies (CEA) (EIIS AA-ROD) in an attempt to lower reactor power to a level appropriate for the single remaining SGFP. Concurrently, they started an additional (#23) Condensate Booster Pump (EIIS SD-P), bypassed the Condensate Precoat Filter/Condensate Demineralizer System (EIIS KD) and attempted to restart #21 SGFP. At 0848, Unit 2 automatically tripped from approximately 100% power on Low Steam Generator (SG) (EIIS SB-SG) Water Level. The Operators performed Emergency Operation Procedure (EOP)-0 (Post Trip Immediate Action) and EOP-1 (Reactor Trip) for a loss of feed trip. The #21 Atmospheric Dump Valve (ADV) (EIIS SB-V) was noted to be controlling RCS temperature low and was selected to manual, limiting RCS cooldown to 527 degrees F. The RCS temperatures and pressures were stable at 0851. The Reactor Protective Systems (EIIS JC) and Engineered Safety Features (ESFAS) (EIIS JE) that automatically activated were the Low Steam Generator Water Level Trip (EIIS JC-LT) and Auxiliary Feedwater Actuation System (AFAS) (EIIS BA) respectively. No Reactor Protective System or Engineered Safety Feature was manually activated.

PERSONNEL ACTIONS

Operator actions were proper and deliberate. No personnel errors caused or contributed to this event.

FAILURE INFORMATION

Two equipment failures contributing to this event were noted: 1) the SGFP trip due to an unknown and unrecorded cause/event and, 2) the inability of the #21 ADV to properly control RCS temperature. The SGFP trip is discussed in detail in the CAUSE section below. The #21 ADV did not function properly due to a zero output point signal of 4.2 mA vice 4.0 mA signal to Hand Indicator Controller (EIIS JC-HIC) 4056. This controller receives a valve positioning signal from the Reactor Regulating System (EIIS JA). The zero output point signal had drifted and was adjusted to the proper value on the voltage to current converter (EIIS JA-CNV) card.

Reactor Regulator System Manufacturer - Rochester Instrument Systems
Model #SC-302

Thrust Bearing Wear Monitor Manufacturer - Indikon Co., Inc.
Model #G/P LD2

CAUSE

The #21 SGFP is one of two pumps designed to supply the SG with water. The SGFP turbine has eleven different equipment protection/ESFAS trips, which include: manual, overspeed, exhaust valve closure, low bearing oil pressure, turbine casing high water level, high SGFP discharge pressure, loss of both lube oil pumps, thrust bearing wear, steam generator isolation signal (SGIS) and containment spray actuation signal (CSAS) trip.

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At 0847, April 27, 1988, the #21 SGFP tripped. The cause has not been positively identified, but the turbine thrust bearing wear (TTBW) monitor circuitry (EIIS SJ) is the primary suspected pump trip initiator. It is postulated that a fault in this circuitry could have erroneously given an excessive turbine thrust bearing wear indication and caused the pump to trip.

A thrust bearing wear trip signal on #21 SGFP was found locked in. Possibly this trip signal was initiated simultaneously with a turbine trip of some other cause, but a post trip review indicated no alarms or out of specification indications of any SGFP turbine parameter. The TTBW alarm signal, a separate circuit branch, had not locked in.

When the cause of the SGFP trip was not readily determined, plant management activated a Significant Incident Finding Team (SIFT) to determine the root cause(s), initiate corrective action(s), and make recommendations to prevent recurrence of the SGFP trip. The SIFT members included Engineering, Operations, Maintenance and Quality Assurance personnel. The SIFT discussed and investigated various plausible scenarios that would cause a pump trip and a lock-in of the TTBW trip signal but without the lock-in of the TTBW alarm signal.

Various trip functions of #21 SGFP and #22 SGFP (which had tripped 18 seconds after the Reactor Trip on a valid high pump discharge pressure condition - the Feed Regulating Valves (FRV) (EIIS SJ-V) shutting) were tested satisfactorily. In addition the entire #21 SGFP trip circuitry was checked for continuity and grounds. No problems were revealed. The turbine thrust was verified to be proper. Investigation revealed the TTBW trip setpoint had drifted to the alarm setpoint in a three week period. The

root cause for the SGFP trip has not been determined. Other trip initiators, in addition to turbine thrust bearing wear circuitry, have not been completely ruled out.

Temporary additional monitoring devices have been installed on the electrical trip circuitry for #21 SGFP. In addition, the TTBW alarm setpoints have been adjusted to a more restrictive range and the TTBW trip function has been removed for #21 and #22 SGFP. This prudent action was taken to minimize single component/system events causing reactor trips.

In consideration of the following information, the removal of the TTBW trip is further justified:

- a) Operators have been made aware of the trip being defeated by written guidance.
- b) Maintenance records indicate no problems associated with the turbine thrust bearing.
- c) A pump thrust bearing is available to mitigate the consequences of turbine thrust bearing problems.

Finally, a replacement for the originally installed Turbine Thrust Bearing Wear Monitor is being evaluated.

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ANALYSIS

The loss of feedwater flow event analyzed in Chapter 14.6 of the FSAR assumes both 100% power and the feedwater regulating valves shutting instantaneously. In this event, the reactor was at 100% power but feed flow was reduced to approximately 74.2% of full feed flow and remained at this rate from the time of the SGFP trip to the time of the Reactor trip (72 seconds). Additionally, the FSAR analysis assumes automatic initiation of AFAS 15.1 seconds after the Reactor Trip Breakers open. In this accident, AFAS initiated 2.6 seconds after the Reactor Trip Breakers opened which is more conservative than the FSAR analysis. Therefore, this accident is less severe than and bounded by the accident described in the FSAR. Calvert Cliffs experienced similar unexplained SGFP trips as noted in LER 84-008 and 85-012. The root cause for these events was not determined. Therefore, corrective actions to address the root cause could not be formulated and recurrence could not be prevented.

CORRECTIVE ACTIONS

1. The temporary additional monitoring of the trip circuit for #21 SGFP will be continued in an effort to determine the root cause of this event. Specific corrective actions to prevent recurrence can not be delineated until the root cause is determined.
2. An evaluation of replacements for the currently installed Thrust Bearing Wear Monitor is in progress.

ATTACHMENT # 1 TO ANO # 8805310341 PAGE: 1 of 1

BALTIMORE
GAS AND
ELECTRIC

CHARLES CENTER P.O. BOX 1475 BALTIMORE, MARYLAND 21203

QUALITY ASSURANCE & STAFF SERVICES DEPARTMENT
CALVERT CLIFFS NUCLEAR POWER PLANT
LUSBY, MARYLAND 20657

May 20, 1988

U.S. Nuclear Regulatory Commission Docket No. 50-318
Document Control Desk License No. DPR 69
Washington, DC 20555

Dear Sirs:

The attached LER 88-004 is being sent to you as required by 10 CFR 50.73.

Should you have any questions regarding this report, we would be pleased to discuss them with you.

Very truly yours,
/s/ J. R. Lemons
J. R. Lemons
Manager - Nuclear Operations Department

JRL:HEN:plv
cc: William T. Russell
Director, Office of Management Information and Program Control
Messrs: J. A. Tiernan
W. J. Lippold

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